Experimental investigations of XCO2 in C-O-H fluids as a result of reacting with serpentinites and spinel-peridotites in the mantle wedge under fore arc conditions

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A key aspect in the Earth's deep carbon cycle is how exogene carbon may be fixed in oceanic crust, subducted into the mantle and recycled within subduction zones. Phase equilibrium calculations and recent experiments suggest that the interaction of slab derived C O H fluids with the overlying (strong serpentinized) mantle wedge will produce magnesite respectively at relevant PT-conditions. The generation of magnesite possibly represents a previously unrecognized carbon reservoir in the mantle wedge.

We present an experimental study on the carbonation of serpentinites and peridotites under fore arc conditions. Piston cylinder experiments have been performed with natural serpentinites and spinel peridotites in the presence of a C O H fluid. XCO2 of the remaining fluid has been analyzed by piercing the experimental capsule under vacuum and extracting the released gas into a gas chromatograph.

We show that the carbonation of serpentinite and peridotite under fore arc conditions is strongly controlled by the activity of CO2 in the fluid phase and is a very quick process even at the investigated relative low temperatures ($500 \leq T \leq 750$°C). With decreasing XCO2 serpentine reacts at 2GPa and 600°C respectively to Quartz Magnesite, Talc+Magnesite and Talc+Antigorite in the M S H C system isochemically (except for the volatiles). The CO2 extraction from the fluid is efficient and hence the generation of carbonates in a serpentinized mantle wedge might have been underestimated in the past.